

*ARGS – AP Calculus  
Summer Packet – 2020*

Dear future AP Calculus AB student:

There are certain math skills that have been taught to you over the previous years that are necessary to be successful in calculus. If you do not have these skills, you will consistently struggle to correctly solve problems next year, even though you understand the calculus concepts. It is frustrating for students when they are doing calculus but are tripped up by the algebra. This summer packet is intended to help you brush up on and possibly relearn these topics.

On the following pages are problems from many different important topics. All problems should be done on a separate sheet of paper, in order, and all necessary work must be shown. **Your work will be due on the first day of class.** To make the most of this packet and to start the semester off right, I recommend you spend some quality time with the packet this summer. Do not attempt to do it all the night before the first day of classes—you will find it a daunting task! I also recommend that you do not rely on your calculator. Almost all problems should be possible to solve using paper, pencil and your brain.

Another don't—don't fake your way through these problems. If you find yourself needing some assistance, please go to one of the websites listed below. In some cases, these sites have full instructions on certain techniques. I cannot emphasize enough that prospective AP Calculus AB students are notoriously weak on these topics, even students who have been very successful in their other math classes. Use the websites. Really. You may also contact me at [lclairmont@args.us](mailto:lclairmont@args.us). I will be checking my emails periodically.

For Algebra Topics:

<http://www.purplemath.com/modules/index.htm>

For Trigonometry Topics:

<http://www.themathpage.com/aTrig/trigonometry-of-right-triangles.htm>

<http://www.anlyzemath.com/Tutorial-Trigonometric-Equations/Tutorial-Trigonometric-Eq.html>

**PACKET SCORING & DUE DATES**

**Due date: First day of school**

- On the first day of school, your packet will be checked for *completion/effort*. This will be *weighted at 50%*.
- The packet will be reviewed in class. Upon completion of the review, you will be given a *quiz* based on the summer packet. The assessment will be *weighted at 50%*.
- The two weighted scores combined will count as one project grade. Therefore, the grade for the summer packet will be placed under the “project” category.
- You may collaborate; however, each of you must submit your own interpretation of the solution.

I hope you have a fantastic and restful summer. I look forward to seeing you in the fall.

*Yours truly,*

*Lilian Clairmont, Ph. D.  
Physics & Calculus Instructor*

# AP Calculus AB Summer Packet

Show all your work.

**Part 1: Solving Equations:** Solve for  $x$

1.  $2(3^{4x-5}) + 4 = 11$

2.  $\frac{6x-7}{4} + \frac{3x-5}{7} = \frac{5x+78}{28}$

3.  $x^3 - 6x^2 - 27x = 0.$

4.  $\sqrt{x+1} - 3x = 1$

5.  $-\frac{2}{x^2} + \frac{1}{2(x-3)^2} = 0.$

6.  $4\ln e = 4$

7.  $x^4 - 6x^2 + 8 = 0.$

8.  $2 \sin 3x - 1 = 0$

9.  $\ln(x-3) + \ln(x-2) = \ln(2x+24)$

10.  $2\cos^2 x - \sin x = 1$  and  $0 \leq x \leq 2\pi$

**Part 2: Equation of a line**

Find equation of the lines passing through (2,4) and having the following characteristics.

11. Slope of  $-\frac{2}{3}$ .

12. Perpendicular to the line  $x + y = 0$ .

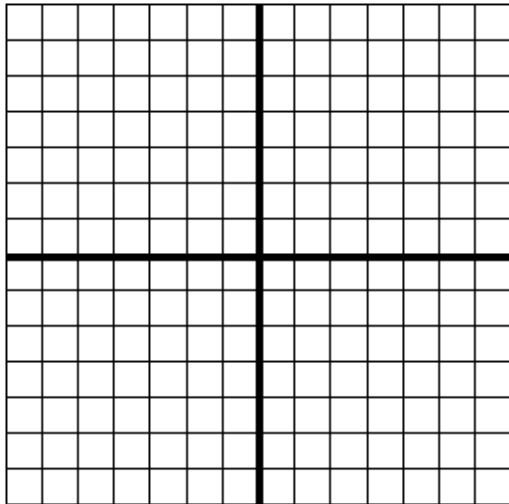
13. Passing through the point (6,1).

14. Parallel to the x-axis.

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Part 3: Transformations: Sketch the following graphs

15. The function of  $f(x)$  is defined:  $H(x) = \begin{cases} 1, & x > 0 \\ -1, & x < 0 \end{cases}$



Sketch the following graphs:

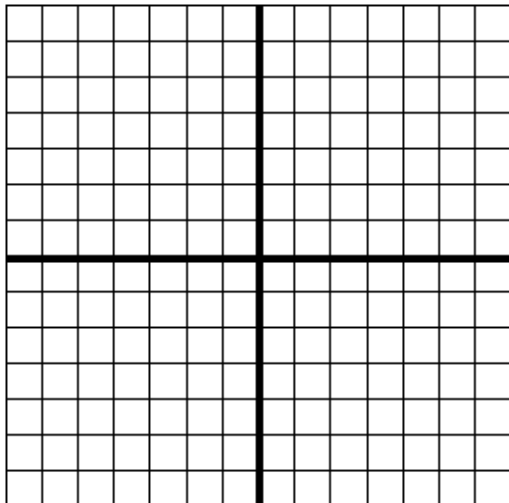
a.)  $H(x) + 3$

b.)  $H(x - 1)$

c.)  $-2H(x)$

d.)  $-H(x - 1) + 3$

16. The function of  $g(x)$  is defined:  $g(x) = \begin{cases} \sqrt{x}, & x \geq 0 \\ x, & x < 0 \end{cases}$



Sketch the following graphs:

a.)  $g(x) - 2$

b.)  $g(x - 2)$

c.)  $-g(x)$

d.)  $-g(x - 2) + 2$

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## Part 4: Operations with functions:

Find each of the following functions or values given  $f(x)$  and  $g(x)$ :

$$f(x) = 1 - x^2$$

$$g(x) = 2x + 1$$

17.  $f(x) - g(x)$

18.  $f(x)g(x)$

19.  $f(g(1))$

20.  $g(f(5))$

21.  $f(g(x))$

22.  $g(f(x))$

23.  $g(g(x))$

## Part 5: Tangent lines

24. Consider the circle  $x^2 + y^2 - 6x - 8y = 0$ .

a.) Find the center and the radius of the circle (change into  $(x - a)^2 + (y - b)^2 = r^2$  where  $(a, b)$  are the coordinates of the center and  $r$  is the radius)

b.) Find an equation of the tangent line to the circle at the point  $(0,0)$ .

c.) Find an equation of the tangent line to the circle at the point  $(6,0)$ .

d.) Find the coordinates of the point where the two tangent lines intersect.

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**Part6: Odd, Even, and Inverse Functions:** Determine whether each function is odd, even, or neither

25. Is this function odd, even, or neither?

$$f(x) = x^6$$

26. Is this function odd, even, or neither?

$$f(x) = \cos(\cos(x))$$

27. Is this function odd, even, or neither?

$$f(x) = \sin(x)$$

28. Is this function odd, even, or neither?

$$f(x) = \tan(\sec(x))$$

29. If  $f(x) = \sqrt{5x - 7}$ , find the inverse.

30. If  $f(x) = \frac{6-5x}{7}$ , find the inverse.

31. If  $f(x) = 6^{3+2x}$ , find the inverse.

**Part 7: Finding zeroes of a polynomial function using synthetic division:**

32. Given the fact that one root of the given polynomial is  $= 2$ , find the other zeroes of

$$f(x) = 2x^3 - \frac{11}{3}x^2 - x + \frac{2}{3}.$$

33. If  $(x + 5)$  is a factor of  $g(x) = x^3 + 9x^2 + 23x + 15$  find the other two factors.

34. Find all zeroes of  $f(x) = x^3 - x^2 - 14x + 24$ .

35. Find all zeroes of  $h(x) = 2x^4 - x^3 - 18x^2 + 9x$ .

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**Part 8: System of Equations:** Find where the graphs intersect

36.  $f(x) = 2x + 3$   
 $g(x) = -.5x + 7$

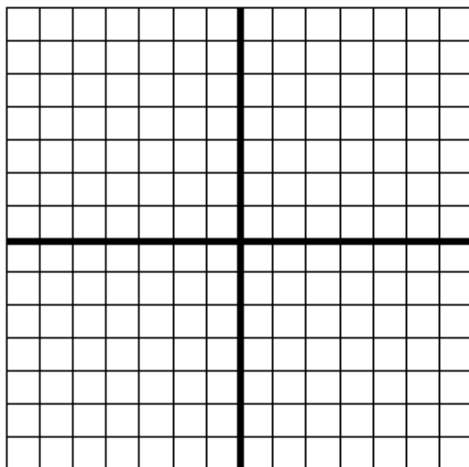
37.  $f(x) = x^2$   
 $g(x) = x + 2$

38.  $f(x) = 6x^4 - 1$   
 $g(x) = 3$

39.  $y = -\frac{1}{5}x + \frac{1}{5}$   
 $x = y^2 - 6y + 1$

**Part 9: Piecewise Functions:** Sketch the graph of  $f(x)$  and find the indicated values:

40.  $f(x) = \begin{cases} x - 2, & x < 0 \\ x^2 + 1, & x \geq 0 \end{cases}$

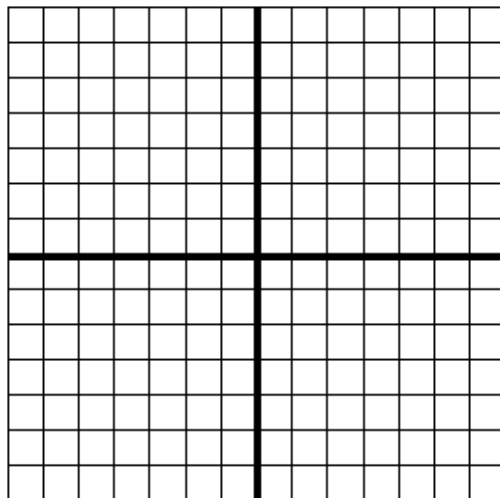


- a.  $f(-4)$   
c.  $f(f(-3))$

- b.  $f(0)$   
d.  $f(f(0))$

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41.  $f(x) = \begin{cases} 6 - x, & x \leq 3 \\ \ln x, & x > 3 \end{cases}$



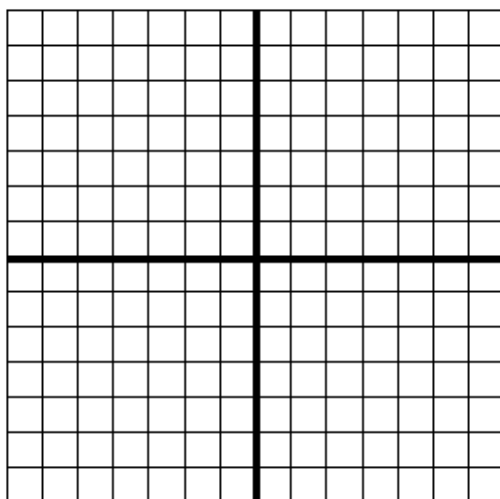
a.  $f(3)$

b.  $f(5)$

c.  $f(f(0))$

d.  $f(f(-1))$

42.  $f(x) = \begin{cases} \sin x, & x \leq 0 \\ x^3, & x > 0 \end{cases}$



a.  $f(-\pi)$

b.  $f(2)$

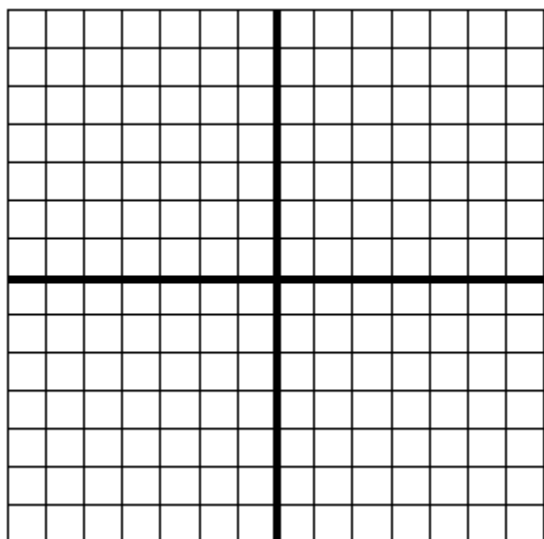
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c.  $f\left(f\left(\frac{-3\pi}{2}\right)\right)$

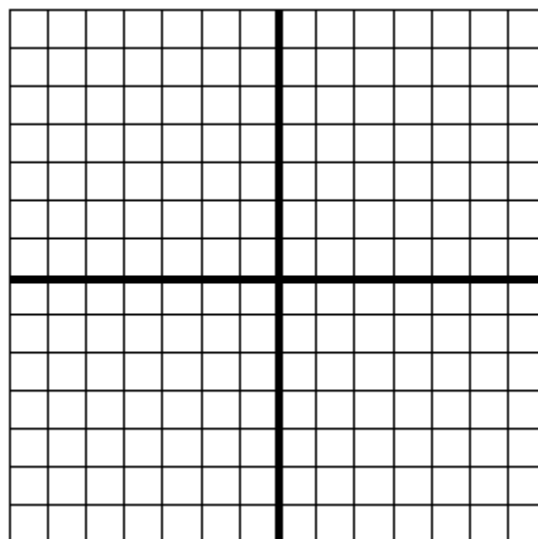
d.  $f(f(0))$

**Part 10: Function Types:** Name the function, find its domain and range, zeroes, and graph it

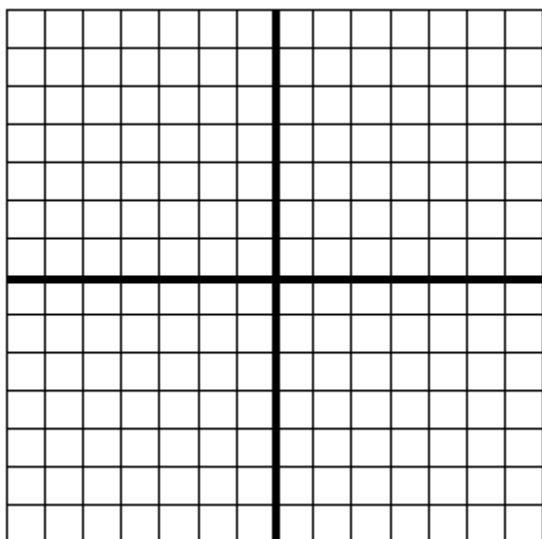
43.  $4x - 3y = 6$



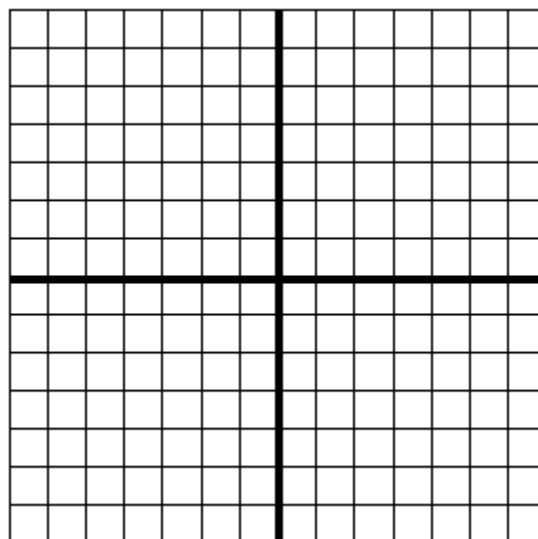
44.  $f(x) = x^2 - 2x - 3$



45.  $y = x^3 - 8$



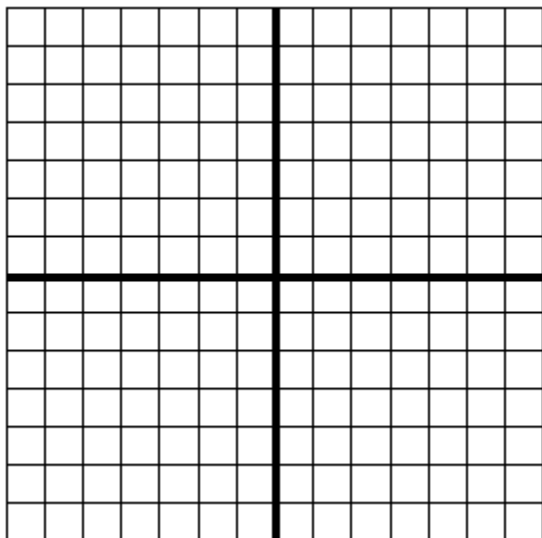
46.  $y = 2^x$



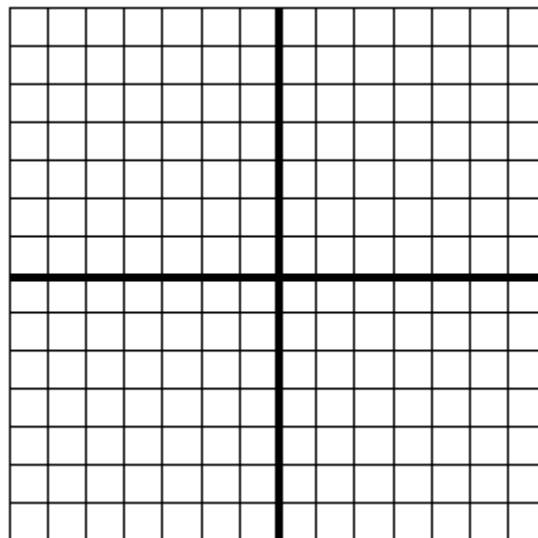


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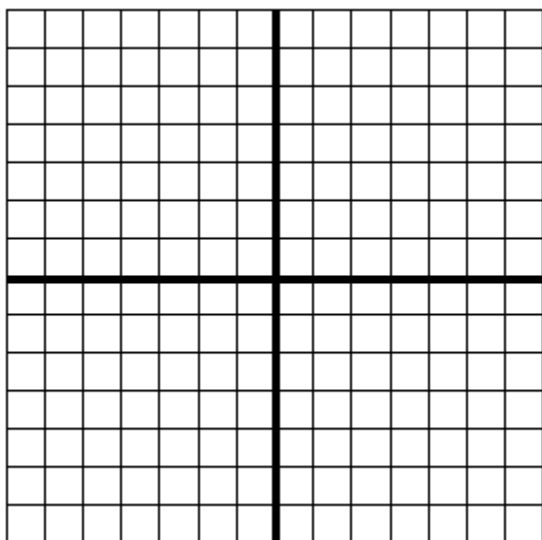
47.  $f(x) = \sin x$



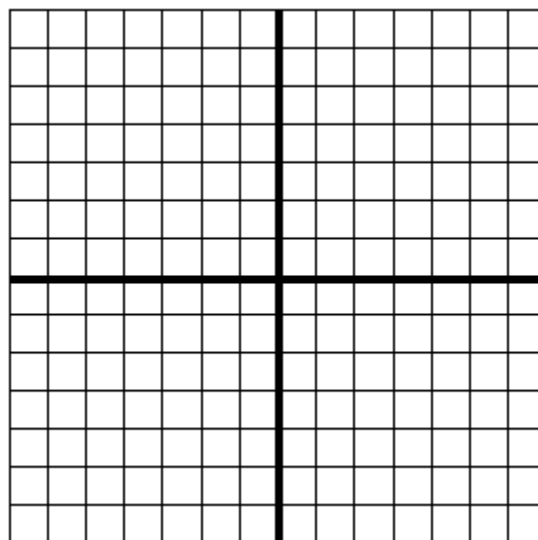
48.  $f(x) = \tan x$



49.  $f(x) = \sec x$

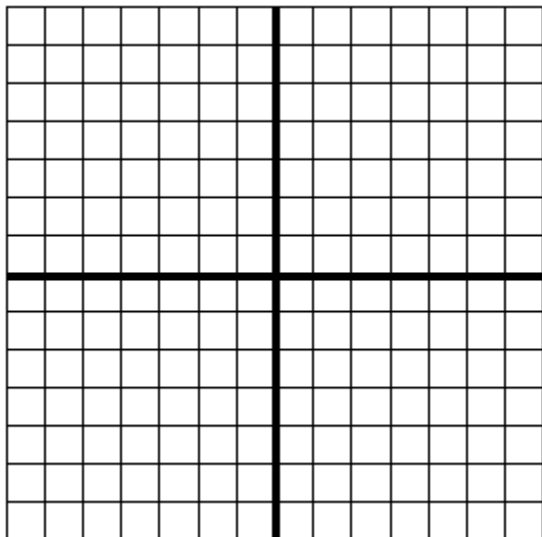


50.  $y = \sqrt{x - 3}$

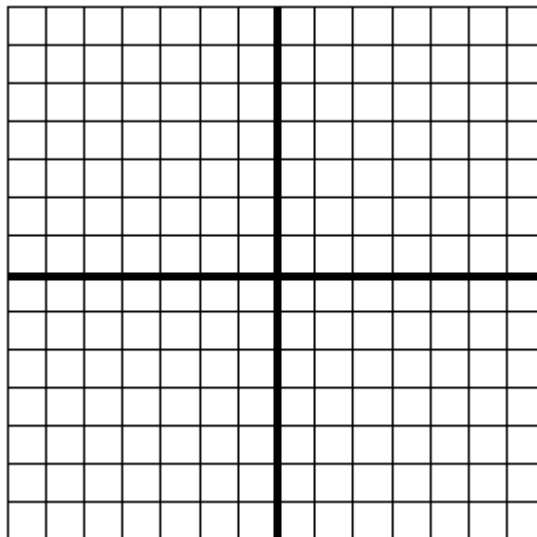


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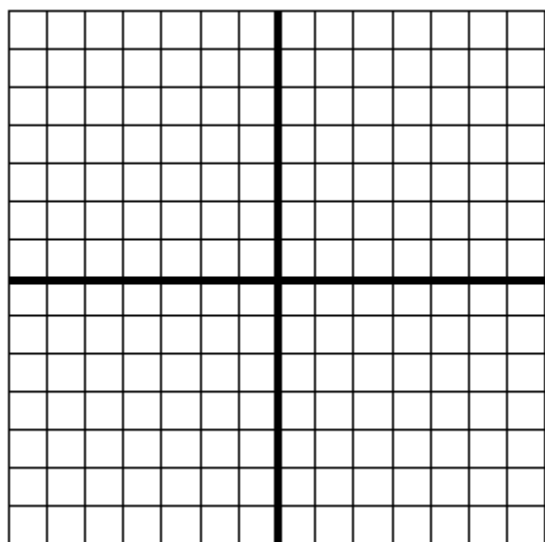
51.  $f(x) = \frac{2}{x-3}$



52.  $f(x) = e^x + 3$



53.  $f(x) = \ln x$

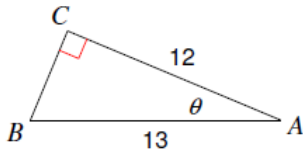


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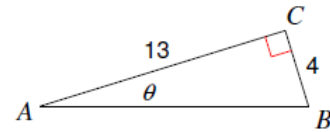
## Part 11: Solving problems involving trigonometry

54. Triangles: Solve for the missing side and  $\theta$

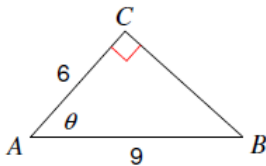
1)



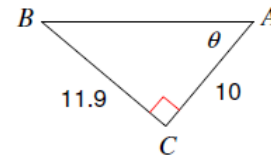
2)



3)



4)



55. Find the equation of a line (in  $y = mx + b$  form) through the point  $(-2, 5)$  with an angle of inclination of  $45^\circ$ .

56. If  $\sin x = \frac{3}{5}$ , find  $\sin(2x)$ .

57. The angle of elevation of the top of a building from a point on the ground 40 feet from the foot of the building is  $60^\circ$ . How tall is the building?

**Part 12: Trig Identities:** Prove that both sides of each equation are equal to each other

58.  $\sin^5 x = (1 - 2\cos^2 x + \cos^4 x) \sin x$

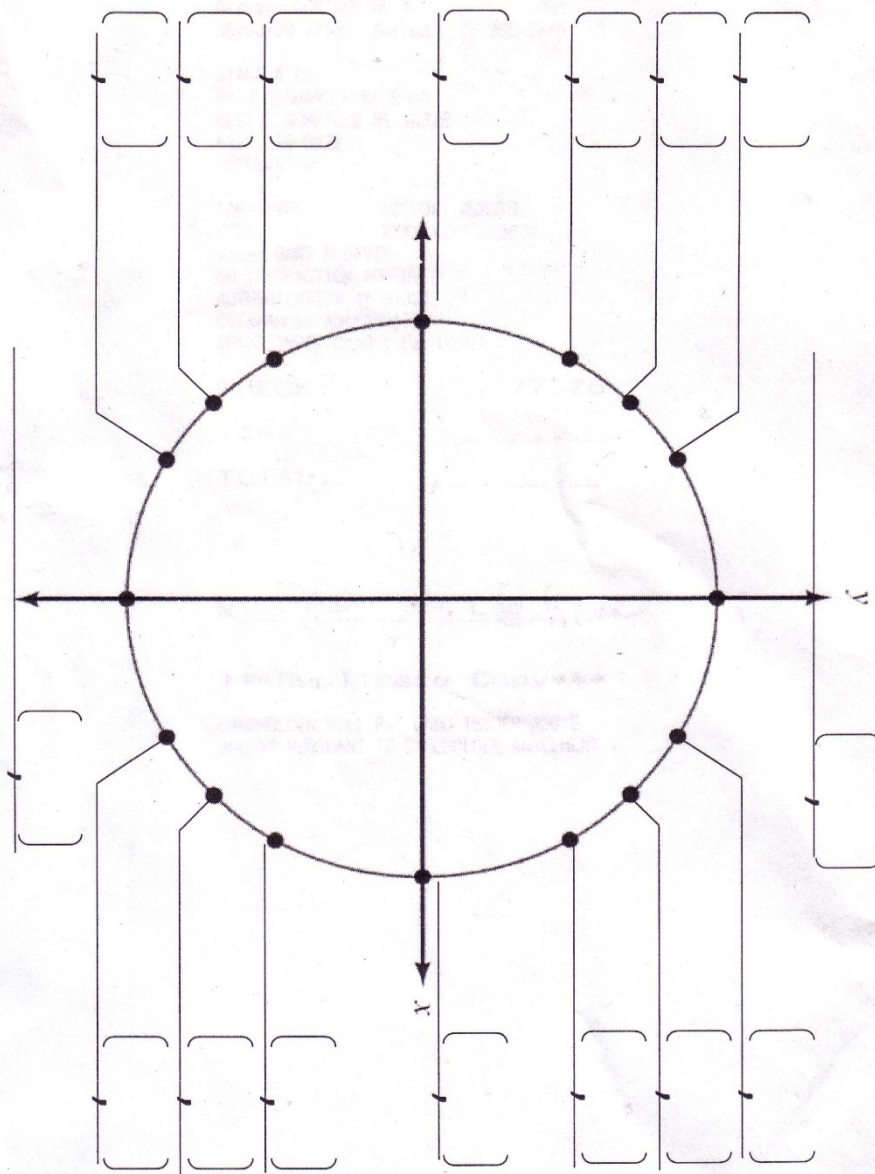
59.  $\frac{\cos^2 x}{\sin x} + \sin x = \csc x$

60.  $\frac{1}{1-\sin x} + \frac{1}{1+\sin x} = 2\sec^2 x$

61.  $\cot x = \frac{1+\cos^2 x}{\sin^2 x}$

**Part 13: Unit Circle:** Fill in the unit circle; label degrees, radians,  $(\cos x, \sin x)$

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Unit Circle  
Label degrees, radians, (cos x, sin x)

NAME \_\_\_\_\_